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Why More Boys Than Girls With ADHD Receive Treatment: A Study of Dutch Twins

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More boys than girls with attention deficit hyperactivity disorder (ADHD) receive treatment. One explanation for this bias may be that boys score higher on disruptive behavior scales than girls. Although this was supported by findings in clinical samples, recent studies in nonreferred samples showed that boys and girls with ADHD are similar with respect to their levels of disruptive behavior as reported by their mother. In this report, we investigate whether the difference in treatment rate is associated with higher teacher problem scores in boys with ADHD than in girls with ADHD. Data were obtained from mothers and teachers in a nonreferred sample of 283 boys and 291 girls with and without ADHD. Children were selected when they scored either low (controls) or high (probands) on attention problems. Mothers completed DSM-IV interviews, Child Behavior Checklists (CBCL) and the Conners Rating Scale (CRS). Teachers filled in the Teacher Report Form (TRF), and the CRS. Boys and girls with ADHD had similar levels of psychiatric illness and school impairment (such as being held back, special class placement and learning problems) by mother report. Mothers reported similar levels of aggression and attention problems in boys and girls with ADHD. In contrast, teachers consistently rated boys with ADHD as having higher scores on reports of attention problems and aggression than girls with ADHD. Gender differences vary across settings: boys and girls with ADHD are rated as behaving differently at school, but not at home. The higher level of teacher reported problem behavior at school may explain the high male–female ratio for ADHD in clinical settings. These findings have implications for the results of genetic studies that rely on referred samples, as these studies may give a distorted view of sex differences in the population.

The boy–girl ratio for attention deficit hyperactivity disorder (ADHD) is estimated at 9:1 in clinical settings, compared to 3:1 in the general population (Gaub & Carlson, 1997). It is unclear why so many more boys than girls are referred for treatment. It has been suggested that the gender difference is due to the fact that girls have lower rates of comorbidity (Biederman et al., 2002). In a review of the relations between ADHD and comorbid conditions, boys with ADHD showed higher rates of oppositional defiant disorder (ODD), conduct disorder (CD), and other externalizing problems, than girls with ADHD (Gaub & Carlson, 1997). This was replicated by Biederman et al. (2002) who found higher rates of comorbidity with depression, CD, and ODD, in boys than in girls with ADHD. However, the interpretation of these findings is influenced by ascertainment factors, particularly the fact that the sample was clinically recruited. Indeed, in general population samples, no gender differences on comorbidity with CD and ODD have been found (Biederman et al., 2005; Levy et al., 2005). For internalizing disorders, comorbidity did vary by gender, but in this case girls with the 'inattentive subtype' had higher rates of separation anxiety disorder, while girls with the 'combined subtype' showed a higher rate of generalized anxiety disorder (Levy et al., 2005).

A second explanation for the gender difference in referral rate may be a differential impact of ADHD symptoms in school settings. Girls with ADHD may behave more adaptively at school than boys with ADHD. Much has been written about school teachers identifying children as needing treatment for ADHD, but to our knowledge, only a few studies have specifically quantified gender differences in teacher ratings with respect to referral for treatment of ADHD. Several groups have studied the behavior of children with ADHD at school. In preschool, elementary, and secondary school, nonreferred boys showed higher rates of ADHD than nonreferred girls (Nolan et al., 2001). In all age groups, boys and girls with ADHD received higher scores on ODD and CD than children without ADHD, but whether the comorbidity with ODD and CD was higher in boys with ADHD than girls with ADHD was not examined.

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A significant interaction effect of gender by diagnosis was found in teacher report data on children with ADHD identified in a school population (Carlson et al., 1997). Girls with the ADHD-combined type received lower scores on aggressive (AGG) and externalizing behavior than boys with the ADHD combined type. However, this study was based on data from DSM-IV Symptom checklists obtained from teachers, and not on clinical diagnoses.

Using the Diagnostic Interview Schedule for Children (DISC-IV) with mothers to validate the presence or absence of ADHD, Abikoff et al. (2002) used trained observers who were blind to diagnostic status to rate the behavior of 502 children with ADHD and paired comparisons (i.e., children without ADHD) in the classroom. The authors report that girls with ADHD obtain lower scores on behaviors related to ADHD and AGG than boys with ADHD. In summary, boys with ADHD show more disruptive behaviors at school than girls with ADHD. It may be that this gender specific finding, in concert with the ADHD diagnosis, leads to the difference in treatment rates between boys and girls.

In this study, we aim to determine how gender, comorbidity, and informant effects influence a child's access to treatment for ADHD. Data were collected in a sample of Dutch boys and girls, selected based on scores on the attention problems (AP) syndrome of the CBCL. A structured clinical interview was completed by mothers to determine if a child had ADHD, and to assess for psychiatric comorbidity. Mothers and teachers filled in behavior checklists on AP and aggression (AGG). Finally, we collected data on school impairment (e.g., repeated class, special class placement, learning problems), and treatment rate. We ask the following questions: 'Are gender differences in treatment rate associated with (a) higher levels of psychiatric comorbidity; (b) higher levels of behavioral disturbance at home; (c) higher levels of behavioral disturbance at school; or (d) greater school impairment in boys than girls?'

Methods

Subjects

The subjects were Dutch twins whose parents voluntarily registered with the Netherlands Twin Registry when the twins were born (Boomsma et al., 2002). As previously described (Derks et al., 2006), subjects were selected on the basis of standardized maternal Child Behavior Checklist (CBCL; Achenbach, 1991) ratings, collected at ages 7, 10, and 12 years. More specifically, twin pairs were selected if at least one of the twins scored high on AP (probands), or if both twins scored low on AP (controls). Standardized *t* scores (mean = 50; *SD* = 10) were computed within gender. A high score was defined as a *t* score above 60 at all available time points (age 7, 10, and 12 years), and a *t* score above 65 at least once. A low score was defined as a *t* score below 55 at all time points. The control twins were matched with proband twins on the basis of gender, cohort, maternal age, and social economic status. The resulting sample consisted of 283 males and 291 females. At the time of the interview, the twins had a mean age of 11.50 years (*SD* = .68). After complete description of the study to the families, all parents signed written consent for participation.

Instruments

The mothers were interviewed by two experienced research assistants. Psychiatric assessments were made with the Diagnostic Interview Schedule for Children (DISC-IV; Shaffer et al., 1993). A child was diagnosed positive for ADHD if he or she met type-A criteria of the DSM-IV (American Psychiatric Association, 1994). Two hundred and forty-eight interviews were audiotaped. A research assistant, who was blind to the results of the interview, listened to 40 of these interviews. The number of symptoms scored by the interviewer and the research assistant showed perfect agreement.

Mothers completed a CBCL within 4 months of the interview (Achenbach, 1991), and a Conners' Parent Rating Scale (Conners et al., 1998b) when the children were 12 years old. Teachers completed the Teacher Report Form (TRF; Achenbach, 1991) and the Conners' Teacher Rating Scale (Conners et al., 1998a) when the children were 12 years old. In the statistical analyses, we included the attention problem scale (11 items) and aggression scale (20 items) of the CBCL, the attention problem scale (20 items) and aggression scale (25 items) of the TRF, and the ADHD-index (ADHD-I; 12 items) of the maternal and teacher version of the Conners' Rating Scale.

Treatment was assessed via two questions that are included within the DISC. The question that was used to assess medication use is 'In the past 12 months, did he/she use medication for overactivity, hyperactivity or attention problems?' The question that was used to assess counseling is 'In the past 12 months, did he/she visit someone in a hospital, outpatient clinic or other institution because he/she was overactive or hyperactive or had attention problems?'. Three measures of maternal reports on school impairment were included: (a) 'Did the child ever repeat a grade?'; (b) 'Was the child placed in a special class?'; and (c) 'Did mother report learning problems in the surveys collected when the children were 7 or 10 years old?'

Statistical Analyses

Chi square tests (χ^2) were performed to assess the effects of gender and diagnosis on psychiatric comorbidity, school impairment, and treatment rate in the total sample. In order to determine which variables are associated with the different levels of treatment rate in boys and girls, the effect of gender was also examined within the group of children with ADHD. To examine the effect of gender and diagnosis on problem behavior scores as reported by teachers and parents in the total population, and the effect of gender in the population of children with ADHD, *t* tests were used. Statistical significance of the 2-tailed tests was determined at $p < .05$.

Results

Demographics

There were 45 boys and 36 girls with ADHD. The relative frequencies of the subtypes were significantly different in boys and girls, $\chi^2(3) = 10.5$, $p = .01$. In boys, the combined type (CT) was most common ($N = 22$; 49%), followed by the inattentive type (IN; $N = 14$; 31%), and the hyperactive-impulsive type (HI; $N = 9$; 20%). In girls, IN had the highest prevalence ($N = 18$; 50%), followed by HI ($N = 12$; 33%), and CT ($N = 6$; 17%).

Treatment Rate

The number of children who receive treatment for problems related to ADHD are summarized by gender and ADHD status in Table 1. Children with ADHD more often received medication, $\chi^2(1) = 89$, $p < .001$, and counseling, $\chi^2(1) = 62$, $p < .001$, for ADHD related problems than children without ADHD. As can be seen in Table 1, in the total sample of children with and without ADHD, boys more often received medication and counseling than girls. Likewise, boys with ADHD more often received medication and counseling than girls with ADHD. This higher treatment rate in boys was not due to gender differences in the rates of ADHD subtypes. For example, in children with ADHD-CT, 64% of the boys and 17% of the girls received medication.

Psychiatric Comorbidity, School Impairment, and Behavior Problem Scores in Children With and Without ADHD

Psychiatric comorbidity, school impairment, and CBCL, TRF, and CRS scores were compared between children who meet DSM-IV criteria for ADHD, and children who do not meet these criteria. The results are summarized in Table 2. In all areas, children with ADHD performed worse than children without ADHD. ADHD children had higher prevalences of oppositional defiant disorder, generalized anxiety disorder, and major depressive disorder, but no significant difference was found for separation anxiety disorder. Furthermore, ADHD children were more impaired at school, and obtained higher scores on maternal and teacher checklist ratings of AP, AGG, and ADHD.

Gender Differences in the Total Population

The prevalence of psychiatric disorders was not different in boys and girls (Table 2). Likewise, boys and girls showed similar levels of school impairment. Gender differences were observed in behavior checklist ratings. As expected, in the general population sample, boys had higher scores on maternal ratings of AGG and on the ADHD-I, and on teacher ratings on AP, AGG, and on the ADHD-I.

Gender Differences in Children With ADHD

In children with DSM-IV ADHD, there were no gender differences in comorbidity profiles, or on measures of school impairment (Table 2). Maternal CBCL and Conner's checklist scores were also not significantly different between boys and girls with ADHD. However, in teacher ratings, some interesting differences emerged. Boys obtained higher scores on teacher ratings of AP, and on the teacher rated ADHD-I. Teacher ratings on AGG were twice as high in boys with ADHD as in girls with ADHD, but this difference was not statistically significant.

Discussion

The purpose of the present study was to investigate why boys with ADHD more often receive treatment than girls with ADHD. Psychiatric comorbidity, school impairment, and problem behavior at home and at school, were assessed in a sample of boys and girls who were selected on the basis of maternal AP scores. Most studies on gender differences in children with ADHD have been conducted in clinical samples. This study adds to the few data that exist on gender differences in nonreferred samples of children with ADHD.

It appears that girls with ADHD have similar profiles of psychiatric comorbidity, and have similar levels of school impairment, to boys with ADHD, but are far less likely to receive treatment than boys with ADHD. Only 6% of the girls with ADHD are prescribed medication, and 8% received counseling, compared to 47% and 38% in boys. These data indicate that ADHD is under treated in girls relative to boys, and also, that the majority of both boys and

Table 1

Prevalence and Treatment Rates of Attention Deficit Hyperactivity Disorder (ADHD) by Subtype in Male and Female Twins With and Without ADHD

		Medication					Counseling				
		Boys		Girls		Effect of gender	Boys		Girls		Effect of gender
	N (boys/girls)	*N*	%	*N*	%	$\chi^2(df)$	*N*	%	*N*	%	$\chi^2(df)$
Total sample	283/291	30	11	3	1	24(1)***	27	10	6	2	15(1)***
No ADHD	238/255	9	4	1	0	7(1)**	10	4	3	1	4(1)*
ADHD	45/36	21	47	2	6	17(1)***	17	38	3	8	9(1)**
By subtype											
Inattentive	14/18	3	21	1	6	2(1)	5	36	1	6	5(1)*
Hyperactive–impulsive	9/12	4	44	0	0	7(1)*	3	33	0	0	5(1)*
Combined	22/6	14	64	1	17	4(1)*	9	41	2	33	0(1)

Note: ***$p < .001$; **$p < .01$; *$p < .05$.

Table 2

Psychiatric Comorbidity, Treatment, School Impairment, and Maternal and Teacher Reports of Problem Behavior in Male and Female Twins With and Without Attention Deficit Hyperactivity Disorder (ADHD)

	ADHD				No ADHD				Total group		ADHD group
	Boys (N = 45)		Girls (N = 36)		Boys (N = 238)		Girls (N = 255)		Gender	ADHD status	Gender
Psychiatric comorbidity	N	%	N	%	N	%	N	%	$\chi^2(df)$	$\chi^2(df)$	$\chi^2(df)$
Oppositional defiant disorder	13	29	10	28	7	3	9	4	0(1)	70(1)***	0(1)
Conduct disorder[a]	0	0	2	6	0	0	0	0	—	—	—
Generalized anxiety disorder	5	11	3	8	0	0	3	1	0(1)	32(1)***	0(1)
Separation anxiety disorder	2	4	3	8	3	1	6	2	1(1)	6(1)*	1(1)
Social phobia	8	18	2	6	2	1	8	3	0(1)	22(1)***	3(1)
Specific phobia	10	22	9	25	18	8	22	9	0(1)	18(1)***	0(1)
Depression	2	4	4	11	1	0	2	1	1(1)	21(1)***	1(1)
School impairment	N	%	N	%	N	%	N	%	$\chi^2(df)$	$\chi^2(df)$	$\chi^2(df)$
Repeated grade	18	41	15	42	54	23	58	23	0(1)	13(1)***	0(1)
Special class	10	22	3	8	12	5	9	4	3(1)	17(1)***	3(1)
Learning problems	26	58	24	67	78	33	79	31	0(1)	27(1)***	1(1)
Maternal reports	Mean	SD	Mean	SD	Mean	SD	Mean	SD	$t(df)$	$t(df)$	$t(df)$
Attention problems (N = 208)	8.9	4.6	7.5	4.2	3.0	3.0	2.7	2.8	2(508)	10(71)***[b]	1(62)
Aggression (N = 208)	15.9	8.6	12.6	8.0	5.8	5.5	4.6	4.6	3(508)**	9(70)***[b]	2(62)
ADHD-index (N = 100)	21.8	8.4	16.4	7.2	7.9	7.2	6.3	6.8	2(218)*	9(218)***	2(27)
Teacher reports	Mean	SD	Mean	SD	Mean	SD	Mean	SD	$t(df)$	$t(df)$	$t(df)$
Attention problems (N = 92)	14.3	7.1	6.6	7.2	4.8	5.2	2.9	4.3	4(221)***	5(39)***[b]	3(33)**
Aggression (N = 92)	12.4	10.9	5.9	8.8	4.2	5.8	2.2	4.0	4(221)**	4(37)**[b]	2(33)
ADHD-index(N = 91)	14.1	8.2	7.2	7.6	4.3	5.6	2.1	4.0	4(216)***	5(36)***[b]	2(31)*

Note: [a]No statistical test could be performed due to the small number of children who met criteria for conduct disorder

[b]Levene's test revealed a significant difference in variance, therefore statistical tests were performed without the assumption of equality of variances

***$p < .001$; ** $p < .01$; * $p < .05$.

girls with ADHD are not being treated. Our findings are consistent with those of Reich et al. (2006), who studied ADHD medication use in a large sample of boys and girls from the state of Missouri in the US. They showed that for children who meet full criteria of DSM-IV ADHD, 75% of the boys and 68% of the girls were in treatment. In addition, 59% of the boys and 46% of the girls received medication. In the current study, we investigated a number of factors that may contribute to this gender bias.

In agreement with the results of Biederman et al. (2005), boys and girls with ADHD obtained similar rates of disruptive behavior disorders. Likewise, continuous measures of ADHD and AGG showed that boys and girls with ADHD have similar levels of problem behavior at home: mothers report fairly similar levels of problem behaviors in boys and girls with ADHD. In contrast, teacher reports of ADHD and AGG do discriminate between boys and girls with ADHD. Teachers report lower levels of problem behavior in girls with ADHD than in boys with ADHD. Although the source of this variance is not clear, the difference between teacher and mother reports on girls provides a point of disagreement between adults who must make the decision to refer a child for treatment. In the case of boys, when mothers report high levels of ADHD, inattention, and AGG, the teacher report often confirms this observation, leading to relative agreement about the need to refer for treatment. In the case of girls, however, although mothers may recognize and report high levels of ADHD, inattention, and AGG at home, the teacher report often does not support the same high level ADHD symptoms, thus diminishing the consensus for the need for referral.

An alternative possibility is that the different treatment rates in boys and girls are due to a different manifestation of the disorder. For example, girls with ADHD may have better physical or psychosocial health than boys with ADHD. Klassen et al. (2004) studied health-related quality of life in boys and girls with ADHD, and showed a slightly worse physical health in boys with ADHD than in girls with ADHD. No gender difference was reported for psychosocial health. In two different areas, however, girls have been shown to perform worse than boys. First, a follow-up study of boys and girls with ADHD reported a higher risk of adult psychiatric admission in girls than boys (Dalsgaard et al., 2002). In this study, 208 subjects (183 boys and 25 girls) who were referred for hyperactivity/inattention, and received treatment with stimulants between 1969 and 1989, were identified. Twenty-three per cent of the subjects had a psychiatric admission in adulthood;

this rate was higher in females than in males. Second, girls with ADHD showed more social problems than boys with ADHD. For example, they were more likely to suffer peer rejection than boys with ADHD (Berry et al., 1985). Furthermore, in the present study, we found similar levels of school impairment in boys and girls with ADHD. In conclusion, it is unlikely that the lower treatment rate in girls is explained by a better disease prognosis.

The toll in terms of morbidity and mortality of the lower treatment rates in girls may be significant. The long term effect of untreated ADHD is well documented. Increased risk of psychiatric disorders (e.g., major psychopathology, anxiety disorders, antisocial disorders, developmental disorders, and substance dependence disorders) in young adulthood (Biederman et al., 2006) and of poor adult achievement (Barkley, 2002) may all be lessened if girls with ADHD are correctly identified and treated.

Conclusion

Overall, our study calls for a careful approach to the assessment of emotional and behavioral problems in girls. In this study we demonstrate a robust informant by gender interaction that may lead to under identification of one of the most common and impairing child psychopathologies. Further, we combine our data with those of others to provide evidence that this gender bias is present in both the United States and in The Netherlands. For the assessment of girls with ADHD, we call for more intensive, gender specific, approaches to be developed. Genetic studies of ADHD which rely on clinically referred samples may give a distorted view of the presence of sex differences in the general population.

Limitations

The results of this study should be interpreted in view of the following limitations. First, further study is required to investigate if the results of the current study, which was based on a Dutch population sample, generalize to population samples in the United States. Second, clinical diagnoses were based on structured diagnostic interviews with the mother. The results may be different when the assessment of ADHD is based on expert clinical diagnoses. Third, because the subjects were selected from a general population sample, the number of children with ADHD was rather small (45 boys and 36 girls). However, this seems inevitable given the fact that the discrepancy of the male:female ratio between general population and clinically referred samples can only be studied when subjects are not selected based on clinical referral.

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